Strategic Appliances:

The Impact of the Digital Home on

The Communications Industries

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A report from the
1999 Las Vegas Consumer Electronics Show

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Strategic Appliances: Themes and Overviews

The Consumer Electronics Show in Las Vegas attracts about 100,000 people during its four-day run. There are thousands of exhibits on many acres of floor space, and scores of sessions, press conferences, and announcements. In a way, the very size of the show is its principal message – this is a big business, and trends emerge here that are important both in terms of markets and social behaviour.

The show is at once very practical and futuristic. Dealers are here looking for new product to move quickly through their stores. They are a useful counterweight to the abundant marketing hype. At the same time "product announcements" are made for devices that are a year or more away, as manufacturers try to establish a position of technical leadership, and concept developers try to attract attention to their ideas in order to license them to manufacturers. The sessions range from "Here's a potential market in ten years" to "Here's how to wire a house right now."

For a Canadian observer, the show is a useful predictor in both dimensions since devices which are consumer realities in the States are often still in our future by eighteen months or so. And since our media and communications industries are so heavily influenced – where not actually integrated – with US industry, the trends for our future are usually the trends for theirs. Economic weather systems tend to move north.

Given the variety and size of the show, themes and trends will depend to some degree on the viewpoint of the observer. That said, in the viewpoint of this observer, there were three themes at this year's show that are definitely worth noting:

- The first is the emphasis on **connectivity**. Most people here saw a potentially huge emerging market in connecting the digital information appliances that consumers are increasingly adopting.

- The second is **the emergence of digital television as a practical reality** as seen in a wide variety of products, from DTV sets and set-top boxes to hard-disk video recorders.

- The third is the **economic model for digital interactive media.** How will people use it? What will they pay for? This discussion, seen from above, is more questions than answers at this stage. Various possible futures were argued passionately in the sessions.

Changing Media Models:

THE DEDICATED RECEIVER MODEL

These three themes are actually elements in a wider vision of media.

Conceptually, 1998 may mark a watershed in our understanding of media, when we moved from a "dedicated receiver" conception of media and their uses to a "dispersed functionality" model.

In the "dedicated receiver" model, the form and uses of media are determined by the abilities of the receiver. That is, a book can be used in certain ways and not others, as can a radio, a television, or a telephone. These are familiar, easily distinguished devices, each of which performs a group of specialized communications functions.

The computer made us nervous about that model. Once the computer became used as a communications tool, we realized that the "receiver" was very flexible. In fact, the receiver was not the hardware at all - it was software. Not only could it change its abilities rapidly, new software receivers – plug-ins – could be downloaded overnight.

In our uncertainty, we began to argue about whether the PC or the TV would be the media receiver of the future. Would the consumers of the future gravitate toward a non-linear, active experience of media, received on the PC? Or would they continue with the passive reception mode that television made dominant in the last half of the twentieth century? Would the two devices converge into one?

The argument developed into a discussion of furniture. Do users want a "lean forward" (interactive) experience or a "lean-backward" (passive) experience? And when they want one of the above, how will we configure the receiver to accommodate it? If all receivers are computers to some degree, do we need to attach keyboards? Hard drives? Wireless mice? High-definition screens? On the walls or in a set?

At this show, that argument was left behind.

THE DISPERSED-FUNCTION MODEL

The current vision of the future in the forward-thinking part of the consumer electronics industry projects that the functionality of both of these dominant appliances (entertaining and informing users) will be broken down and spread through the user's environment onto a variety of stationary, mobile, and hand-held devices. Each of these will perform some subset of functions, with various compromises based on the form factor of the device, its cost, and its ability to connect.

The latter is perhaps most important, because it is assumed that all of these devices will be able to connect to each other, either on specialized localized networks or across that network

of networks, the Internet. Given that assumption, the bandwidth of the connection becomes one key to the capability of the device.

So, in this vision, a telephone does many things – it receives stock quotes and sports scores, it receives and sends email, it browses the Web, it even allows you to make a phone call. But since it has a small screen, and since it may be sharing public cellphone bandwidth, it isn't really used for video entertainment.

Or - you may own a phone that just makes phone calls, while you carry a PIM that performs the other functions, and a portable TV receiver. Or - you only have the mobile TV receiver in the back of your car where you can manage a larger screen, and so on.

In other words, you can split the media functionality we are used to now among a wide variety of devices which may be configured to handle only one function, or which may be configured to handle several. And they are all interconnected, so the flow of information and entertainment can move to you wherever you are – albeit in a thinner, less rich media stream if the appliance has lower-bandwidth connectivity.

IMPLICATIONS OF THE NEW MODEL

If this vision is achieved, will we still think of television as television, web pages as web pages, and newspapers as newspapers? Not likely. Not that these individual media will not survive – the history of media shows that very few are actually completely replaced by the "next big thing"[1] – but that the dominant form of information media will be a stream of digital objects, a scalable mix of text, data, still pictures, audio, and video. The device we are using at the moment will select the elements it is capable of receiving from this scalable stream, and interact or permit response also to the limit of its capabilities.

The huge variety of media appliances that could result to serve this fragmented but interconnected media universe would vary on their capabilities on three dimensions. They will provide:

- A rich or thin media experience delivered to the user
- Greater or lesser portability
- Greater or lesser interactive abilities from the user back to the network

The media provider, faced with uncertainty about the nature of the receiver, will have to configure the information so as to provide complete experiences at all scales. To achieve this flexibility at reasonable cost, standards will have to be established – a theme we will see throughout this discussion.

[1] But their uses change. Radio ceased to be a story-telling medium when television arrived, but continued as an information medium and a companionship medium based on music. The only media I can readily recall that were effectively replaced were the telegram and its successor the teletype, which I recently tried to describe to a disbelieving 30 year old.

Theme 1: The Networked Person in the Connected Universe

A central theme in this vision is that media functions can be spread over a wider geographical space, in order to follow users wherever they may need them.

Work-related information functions follow the user home, to the home office – a part of the digitally networked home. In the home, entertainment signals are moved from room to room, and specialized new functions are added: once again it's proposed that the computer will invade the kitchen to help in food preparation via the "kitchen pad" appliance and the smart refrigerator.

Wherever one can put a screen, it is to be connected to all sources, and perform many functions with the intelligence of the network backing it up. Its use depends on what's in front of it. An office chair, for a "lean-forward" experience? Or a couch, for a "lean-backward" experience?

In the car, information functions are provided by a variety of multimedia devices all interconnected through a standard called IDB.

And wherever there are hand-held devices, descendants of the Palm Pilot and cell phone, they also are expected to have routes to connect to the vast pool of information so that users have immediate access to their messages, however delivered, and also to other data – phone books, stock quotes, sports scores, etc.

CONNECTIVITY AT HOME:

The richest entertainment experiences will be delivered by stationary devices in the home. The manufacturers believe that people will expect to be able to watch television, listen to music and radio, and browse the Web anywhere that they place a screen or speakers, and they will expect to be able to control that experience with their voices or from a touch pad anywhere in the house.

I was positively nostalgic when several people raised the idea of the "kitchen pad", somewhat fancifully placed on the front door of a microwave oven, so that people could access recipes while watching cooking shows on television, and even order the ingredients. As I recall, cataloging recipes was supposed to be one of the main functions of the Apple II and Tandy 100. Perhaps the time has finally come for this "killer app".

Or perhaps not. But while this application may ultimately prove to be marginal, there are plenty of other drivers to encourage connectivity in the home.

The optimists reel off a long list of uses for a home network:

- connecting multiple computers to share data
- home security, for example viewing security monitors or baby monitors from any screen in the house

- sharing high-speed access to the Internet among several devices
- sharing cable connections among all the televisions in the house
- allowing people to control their home lighting, heating, security, stoves and other kitchen appliances, from a remote location over the Internet
- allowing many devices in the house, including portable email, telephones, and hand-held PIMs to access the Internet through the home "gateway"
- connecting audio/video appliances, like camcorders and digital cameras, to each other and to computers
- downloading digital music directly from the Internet to home audio appliances

Those who believe in this vision see a couple of these functions as compelling drivers; the remainder will be add-ons to an existing infrastructure. However, there are competing visions, with different notions of which functions are compelling.

- The big audio/video manufacturers see home entertainment as the driver. They are building IEEE1394 (a.k.a. Firewire, iLink) connectivity into most new digital devices so they can be easily linked together with a single wire and with signals remaining in the digital domain, thereby increasing quality.

- Companies involved in the computer industry see the sharing of computer resources, particularly high-speed Internet access, as the driver. Moving video signals around the house – a very high bandwidth application – is lower on their agenda.

The consensus is that the resulting network must be simple to use, inexpensive, trouble free, high bandwidth and basically invisible to the consumer. The special problem of wiring the home has led to a number of solutions involving “no new wires”.

Supporting Technologies

There are a variety of technologies required to support the home network. None currently meet all of the above criteria.

Some solve the “no new wires” problem by building wireless networks. Two technologies using the 2.5 GHz spectrum were Sharewave and Proxima (described in the next section). The principal problem they must overcome is the electrical “noise” in the home environment from microwave ovens and other appliances, and they use a variety of spread-spectrum and other techniques to accomplish this. The main knock against them is low bandwidth, although the vendors claim new compression techniques to dramatically increase throughput.

While most concede that there is a role for wireless in home networking, if only to connect personal devices into the Net, or to connect the car in the garage into the home net, there are still issues around standards, which the HomeRF group is trying to solve.

Others solve the “no new wires” problem by using the telephone wires already installed in the home, without disrupting telephone service. Again, bandwidth is an issue. The “standardizing” group (HomePNA) has released a spec that goes to 1 Mbps, expecting it to

rise to 11Mbps this year. Proprietary technologies like Avio claim much higher rates, but at the cost of requiring a new phone line for phone service, or installing special adapters. (see next section)

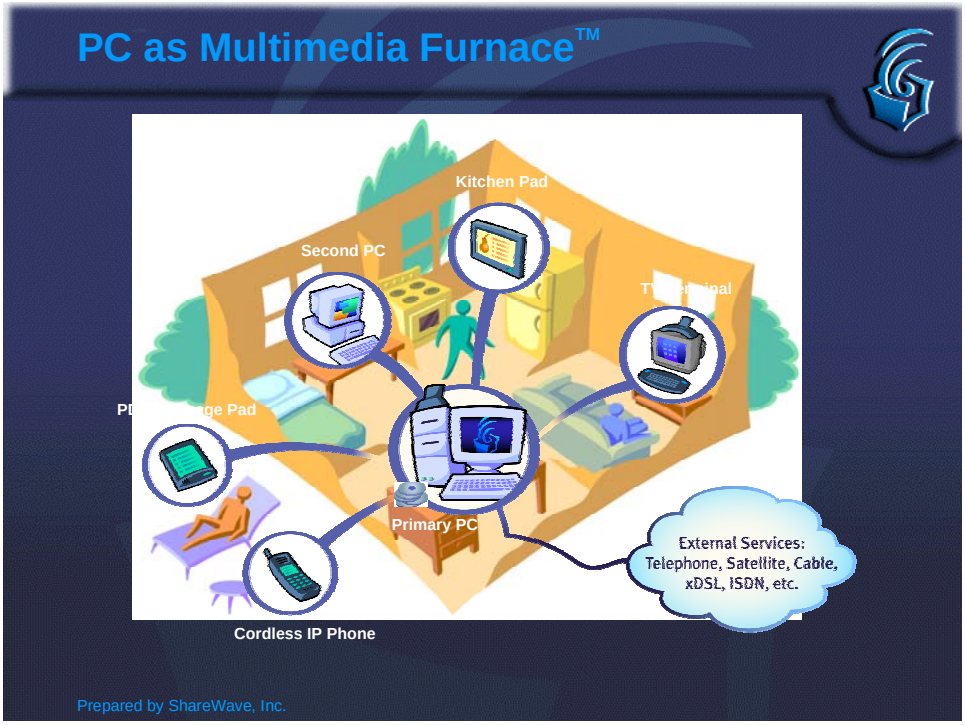
On the horizon, there is an expectation that the power cables in the house will also be used, but no solutions were being offered at the show. The pervasiveness of electrical outlets makes them an attractive alternative.

The IEEE 1394 solutions are not literally "no new wires", of course, but the A/V manufacturers see part of their appeal as being able to replace the many wires that currently connect pieces of A/V equipment. Its big advantage is that 1394 has very high bandwidth, but its use in general home networking is discounted by some who see the relatively low connection distance (about 10 feet) as a big barrier.

Nonetheless, 1394 cards for computers are being built; Eurocom has a notebook with a 1394 connector; and Samsung was connecting their AV equipment to a computer using Internet Protocols over a 1394 network at the show, albeit at very low speeds in their prototype. (see next section)

Beyond the wiring, however, there are also issues about the need for a network "hub" somewhere in the home network. The need arises even in peer-to-peer networks, to

- connect different network topologies together - 1394, wireless, and even legacy home security systems
- share access to a high-speed link outside the home, e.g. a cable modem, ADSL modem, or satellite link



IBM's home networking system has a dedicated hub in it, at a high price compared to most

vendors, but it's also possible that one or more devices on the network could do double duty as the hub - the computer, for example, or the cable set-top box. This slide, from Jim Schraith's presentation (Sharewave) shows one of their possible solutions - the PC as the gateway. How this issue is solved is important because of the concern over who owns the gateway into the home.

Barriers: The Connected Cocoon?

Why would anyone want a home network?

Anyone who has used an office LAN knows that networking can be full of problems, starting with the difficulty and expense of wiring and continuing through problems with compatibility and competition for resources that can slow down access to information or even shut down the network completely. Office networks require frequent attention from expert staff -- who would want this in their home?

Many of the entertainment uses may be "cool", but few seem likely to become essential. Most of them can be performed adequately now with a certain amount of trouble connecting wires, or through dedicated home security networks etc.

Those conference attendees who are involved in actually installing home networks are skeptical that the goal of consumer "invisibility" can be achieved anytime soon: they see an ongoing need for expert maintenance, and consequently a fairly heavy cost for these networks. This cost keeps networking out of the envisioned "consumer" category; for a time it will remain in the "home investment" category.

Driving Connectivity: The Convergence of Home, Office and Mall

That does not mean that home networking will not expand, however. The vendors who are trying to position it as a consumer item may be missing the biggest driver: the penetration of the office environment into the home.

Office work no longer ends at 5 o'clock to begin the following morning at 9. For more and more people, work continues through lunch, into the evening and over the weekends. As a consequence, many workers have computers at home -- and want to have the same facilities at home, e.g. high-speed connections to the Internet, that they have in their offices. Still others have actually moved their offices into their homes and "go to the office" by climbing a flight of stairs.

The drive for personal connectivity is also outside the home. For example, the global nature of business has increased travel. The traveling worker requires a laptop, a cell phone, and a portable organizer to make the most efficient use of their time.

And finally, the accelerating pace of business has created a demand to use every possible hour in order to move business forward rapidly. As John Chambers said in his keynote

address at the convention, "If you miss the market by one quarter, you lose 20% of the market. If you miss it by two quarters, you might as well not enter it at all."

Work is a very significant driver because we place a much higher value on work tools compared to consumer tools. One minute of cell phone usage may cost as much as a month's subscription to a cable television channel – in each case, that's what the market will bear. The penetration of computers into the home has been driven, first of all, by our need to work at home -- and by extension, the need to educate our children so they can improve their income prospects -- not by the need to organize recipes or Christmas card lists.

However, entertainment has piggy-backed on work. The construction of railroads and highways may have been driven by commercial and economic needs, but the personal traveler on vacation was quick to use the infrastructure once it was there.

And let us not forget shopping. The drive to consume is as strong as the drive to entertain ourselves. This year's Christmas retail numbers over the Web have many people excited; now they are concentrating on making Web shopping a richer more rewarding experience.

Assessment: From Hype to Skepticism to Realism

In short, home networking is currently in its "hype" phase. We can expect a following phase in which the difficulties and dilemmas associated with the technology become obvious and discount the hype.

However, as the technology problems are tackled and an early-adopter market driven by work needs develops, estimates of market size and penetration rates will become reasonable. In the long run, we can expect home network infrastructures to become common and ordinary, as more and more people acquire digital appliances and the cost of connecting them approaches the value of connecting them.

I say this because there are compelling drivers for connectivity. Work is one. Personal security is another function that carries a high price tag. People will pay for in-home security, in-car security, and such odd but compelling applications as remote video monitoring of the home or day-care center from work over the Internet, in order to ensure that one's child is well cared for.

As a consumer cost, people will share their entertainment resources throughout the house, whether that means distributing a cable or satellite connection to a variety of sets, or simply being able to listen to their multi-CD player in any room of the house.

My personal opinion is that the comprehensive home network scenario will take ten years to roll out. In the short term, there will be a demand to connect "islands" within the house. Those who buy new audio/video units will get 1394 connectivity built-in, and since it is simple to use, they will use it.

But they are less likely to connect 1394 to their computers. One of the interesting observations of the conference was that about half of all home computer users have their

computer in the same room as the television set, and are thus able to combine passive viewing with interactivity without any complex connections or all-in-one devices. Many of those who make use of the online accompaniments to TV shows from such providers as E! do so in this way. (see Sessions, “Entertainment, News, Sports and Finance”)

A more deliberate demand for the home network infrastructure will come from the multi-computer household. Some analysts see the need to share a relatively expensive high bandwidth connection into the home as the biggest driver. John Todd, of Wedbush Morgan Securities (see Sessions, “Views of the Digital Home”) saw the market for high bandwidth Internet connections -- whether cable, satellite, or XDSL -- growing at exactly the same rate as the market for home networks.

The technical limitations of current home networking technology would also lead one to the conclusion that the "computer islands" will not be readily integrated with the "audio/video islands" due to differences in bandwidth.

However, if we assume that these limitations will be overcome within ten years, so that inexpensive, easy, reliable home networking is available to the consumer, we can look forward to some substantial changes in behavior.

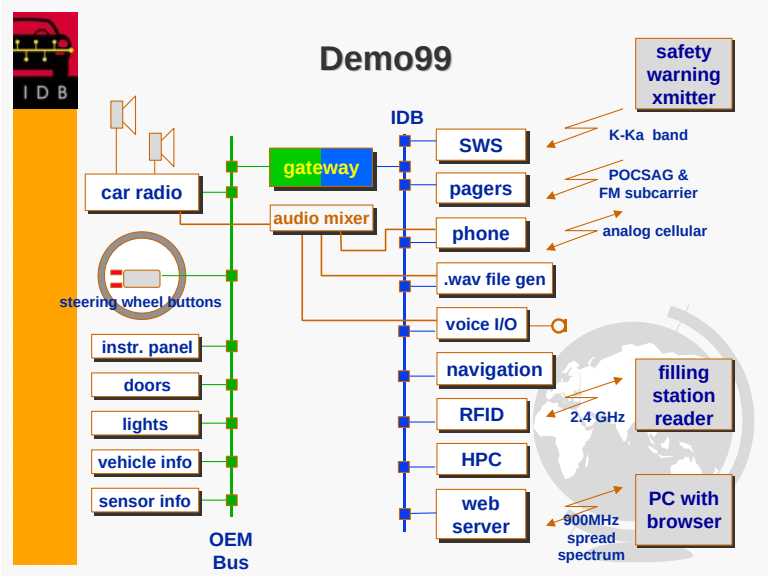
The Audiovox P-44 is a Radio, CD, and TV for the car

CONNECTIVITY IN THE CAR:

There were acres of "wonder cars" at the CES, including devices that network the various parts of an automobile.

The vision of car networks is, again, a multimedia vision, with a variety of devices providing information to a driver and passengers from sources outside the car, including email, movies to screens in the back seat, global positioning, etc.

The diagram at right, from Allan Kirson's (Motorola) presentation, shows the kinds of devices that were contemplated in the IDB demonstration at the show. It shows, on the left, various devices for the car itself, installed by the manufacturer. On the right, connected to the car network by a gateway, are a variety of third-party devices.



My particular favourite is the "filling station reader" – as the car passes a Shell station, it exchanges information with the station's computers over a wireless link. If the car needs fuel, it will advise you that there's a station nearby and you can turn in to fill up.

The Carin 440 radio / navigator gives directions audibly and on-screen.

The ".wav file generator" is there to permit the car to speak to the driver over the radio speakers, while "voice i/o" permits the driver to control the devices by speech.

Another application, not illustrated here, allows the car to communicate with your home network once it's in the garage, so that the manufacturer's maintenance program can query the car about its state over the Internet, and send you an email when servicing is required.

Supporting Technologies

The car network is somewhat opportunistic. That is, the vision of multimedia devices is built on the manufacturer's existing wiring. As more and more of the car itself becomes computerized, manufacturers are using a single wire around the car to connect these devices,

to both control them and allow them to communicate diagnostic information to the driver or mechanic. (See Section “Some Booths on the Show Floor” for a fuller description of IDB)

Barriers

The barrier is the lack of standardization in car networks. Each manufacturer has a proprietary system. The Society of Automotive Engineers (SAE) has designed a standardized data bus, IDB, which interfaces to the proprietary data busses so that devices need only to be built once to connect to any car network. Because of the lead times involved in car manufacturing, this standardization is essential to allow consumer manufacturers to respond to demand.

Assessment: Security will drive drivers; lower cost will drive manufacturers

To me, the most significant developments in consumer car electronics have to do with security and global positioning. The enhanced audio/visual toys, and even the work related tools like email, paging, and telephony, will have less initial impact in terms of consumer acceptance than the security devices.

The Carin 550 navigator has a 5“ screen, GPS, and motion-sensing technology.

The ability of the car to tell the driver where it is and how to get to where it's going will certainly add convenience and peace of mind to travel, and may even do something to improve traffic flow and the driving experience. One class of applications permits the car, in case of accident, to call the nearest police and ambulance services, and even give them the car’s position based on global positioning (GPS) data. This kind of application responds to a much more basic need than the multimedia applications, and is likely to be a stronger driver of adoption of “connectivity” devices.

The network infrastructure itself, however, will be built into more and more cars as time goes on, so eventually we may see all automotive devices with standard interfaces to connect to it. It would be fair to say that this market is driven more by makers than consumers at this point. That is, the car manufacturers are themselves creating networks to connect the various digital devices and controllers within the car in order to simplify their own engineering. Third party consumer manufacturers are working to standardize those networks so that they can easily develop audio, video, navigation and communication devices to work with that network. The concept is, "let's connect everything with one digital wire, rather than 100 special purpose analog wires."

CONNECTIVITY IN THE POCKET: THE PERSONAL NETWORK:

The industry vision includes an expansion in consumer use of portable devices moving in and outside the home. Industry analysts at the show projected that further expansion of the mobile telephony market depends on the provision of additional information services. That is,

- basic cell phone service is becoming a commodity, and margins are low
- replacement buyers will soon outnumber new cell phone buyers
- in this more demanding market, mobile telephony will have to add value through information services that build customer loyalty

Consequently, we've already seen the development of the combined information manager and cell phone, a device that maintains calendars and address books, and can receive and send pager messages and faxes. Future developments will include the ability to access Internet information services through a simple graphical user interface.

The Audiovox hand-held Global Positioning Device

This group of devices may go beyond the obvious into such notions as heart monitors that can communicate with medical services and to provide alerting in case of trouble. There will also be an abundance of smaller and more powerful "notebook computers -- and many devices that fit somewhere between the PIM and notebook, as the personal computer's functionality is dispersed across a variety of more specific hand-held devices.

One change in these devices will be the capacity to link to both home and business networks for easy uploading and downloading of information. In other words, short range wireless connectivity – in addition to the more expensive cellular connectivity – will be needed. Conversely, both home and business networks will need to acquire wireless connectivity to accommodate increasing numbers of these devices.

Barriers

The greatest barriers to the vision of connectivity are cost and form factor. Not only must the devices themselves be inexpensive, the connect time and the cost of services must also be low.

In addition, those who see web browsing as a common portable activity may be disappointed. Neither the small size of the devices nor the situations in which they are commonly needed are conducive to this media behaviour (as we currently understand it.)

Assessment: Info to Go

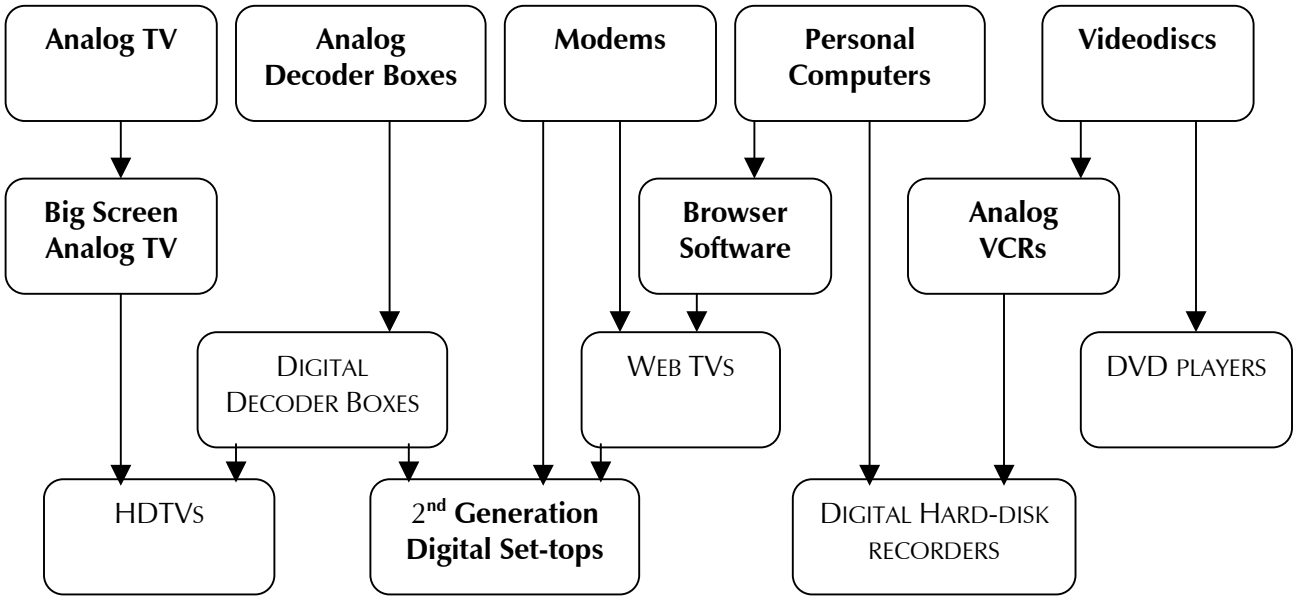
Again, work needs are probably the greatest driver for more extensive connectivity in the pocket. The explosive penetration of cell phones and hand-held personal organizers are clear indication of the need. If their functionality can be improved at low cost, they will be even more popular.

On the other hand, "web browsing" as such may not be a big driver. As we currently understand it, the Web is already too rich an experience for the form factor of hand-held devices. There are various schemes for on-the-fly "thinning" of web page content so that only the essential material is transmitted to the device, however, it is just as likely that we will see an entirely new Internet-based object developed to feed thin lines of information to these devices.

Reducing connectivity costs may come about through 3rd generation wireless, but some part of the need could be met by accessing the digital data streams of television and radio broadcasters (even RDBS on analog FM stations), which are an ideal architecture for delivering commonly-needed data such as general news, stock quotes, and sports scores. An on-demand architecture could also be devised using parts of the cell network in combination with broadcasting, in much the same way as satellite broadcasters use a telephone return line but ship data through the satellite to the PC.

Theme 2: The Reality of Digital TV

It would be inaccurate to claim that the rollout of digital TV is a clear example of the new vision of dispersed media functionality. It clearly is not, because the tools being presented to the consumer are a mix of the old "receiver-determined" model and the new. In fact, these tools show their ancestry clearly. The family tree looks like this:



HDTV sets, in their current form, are an extension of the old model of the all-in-one dedicated receiver, which presents linear entertainment superbly. They have the potential to be much more (integrating many more functions) or to break up their functions into components of decoder and display.

The set-top box is also an integrating device, combining three functionalities into one. As decoder, browser, and modem (and possibly network hub), they are being positioned to be the dominant "gateway" into the consumer's home.

The wild card in the new generation of media tools is the digital hard-disk recorder. A potentially revolutionary device, it performs the job of storing and playing back video entertainment in ways that may change our use of television profoundly - but since much of its functionality is in software, it could do much more.

Even here, the integrating strategy is at work, as both Echostar and DirecTV have announced plans to integrate a hard-disk recorder into premium satellite receivers along with browsing software.

DTV Sets: The Initial Rollout

Strategically, DTV sets were not very newsworthy at the CES. The principal development was that they are now a (rich) consumer reality, not a prototype. They are still very expensive for the most part, though Thomson announced a decoder box at a lower price. With the HD display included, however, receivers will still be in the $7,000 to $9,000 (US) range. Wallscreen displays were also available, though the only HD wallscreen (720p) is still around $25,000.

The headline is that the sets are out there with the dealers and selling, and the broadcasters are indeed getting their towers up and are transmitting. There have been a few glitches, but basically the rollout is going according to plan and the sets appear to be selling at CEMA prediction rates – it's neither a stunning success nor a washout, so far. HBO's provision of HD service via satellite is expected to drive greater acceptance this spring.

The one fly in the ointment was the surfacing of worries that the US chose the wrong transmission standard in 8VSB – that it will not reach enough consumers over-the-air conveniently. There is an element of "told you so" here, since Canadian engineers urged a closer look at OFDM (the transmission technology adopted in Europe) during the standard-setting process, and now touted as a possible answer. (see Sessions "Broadcast Television Roundtable")

In their current form, however, these are still positioned as rich linear media experiences. There is little effort going into using their digital capabilities for interactivity.

Cable Set-Tops

Just the opposite is true of cable set-top boxes. The strategic direction of the cable industry is toward the provision of more interactive services, and the new generation of set-tops is key to that direction. These boxes will contain cable modems, and browser firmware to allow the user to surf from the TV.

This is, of course, causing a stir in the interactive media community. Much work is going into the design of user interfaces, and constructing services that will work well on these boxes, so that they can be sold to the projected new generation of Web users.

The big question is the economic model. It's generally conceded that someday, Web businesses will have to make money – and the cable set-top is seen as a way to finally generate revenue in significant amounts. What the box will do to advertising and eCommerce was the subject of considerable discussion. (see sessions, "Strategies for Broadband and Narrowband Entertainment")

A confusing part of the economic model is that cable boxes are set to become retail items by July 2000 by FCC order. Cable companies will still control the conditional access part of the box, however, and will still control authorization of reception of their services. No one was quite sure whether this development will erode cable's gatekeeper position or not.

HARD-DISK VIDEO RECORDERS: THE END OF PRIME TIME?

Digital video hard-disk recorders were a surprise at the show. While they were anticipated, seeing them and their capabilities firsthand brought a sharper appreciation of the change they may bring to the average person's use of media.

Briefly, these units look like a VCR and sit on top of the box with cable or other reception methods plugged in, and an output to the TV. Because they can both record and play back video at the same time, you can do some surprising things with them.

- You can "pause" live TV on a nice clear still frame while you do something else, and resume watching where you left off. If you want to catch up to "real time", you can triple-speed forward until you're caught up.

- You can look at sports replays as often and as long as you want without losing any action, simply by telling the machine to go back fifteen seconds and play. Since it's still recording, you don't miss anything.

- You can instruct the machine to record shows from a sophisticated program guide (up to 10 hours in the current versions) or you can get it to record shows based on its assessment of your viewing patterns and preferences. You train it by using "thumbs up" and "thumbs down" buttons on the remote. When you sit down to watch TV that evening, it presents you with ten hours of recorded material to your preferences, all of which you can access instantly with no rewinding or fast-forward. (see Section, "Some Booths on the Show Floor" for more)

These devices are already at consumer price points. Plans are in place to build them into set-top boxes and satellite receivers. When you see them in action, they are instantly appealing, because of the control they bring to the television experience.

The driver here is obvious – people still want to watch television, and seek choice hoping that there will be more good shows if they have more channels. To some degree they are disappointed in the quality of what they can watch, and overwhelmed by the number of programs. This machine helps make television choices for you, providing greater control over the experience, including the commercials.

Theme 3: An Economic Model for Interactive Media

The interactive media theme found its expression in discussion and in announcements, rather than in new hardware or software on the floor of the show.

The central problem under discussion was, “what’s the business case?” and, “How do we make money at this?”

Much of the discussion centred around the link with television on the one hand, and commerce on the other. That is, a convergence of linear and non-linear media seemed to promise the best results, because:

- The mass audiences of television are seen to be necessary for serious revenue of any kind
- The “buying behaviour” of television watchers is seem to be more conducive to successful eCommerce
- Advertisers are in television now
- Cable’s ability to capture the gateway to viewers / consumers is seen as a key asset, forcing content providers of all kinds to come to terms with their dominant position

Perhaps the most interesting discussion centred around what would happen to the economic model for television in the new world. While last year the discussion might have ranged wider over the possibilities of interactive programming, the question, “How do you make money at it?” narrowed the range considerably.

A widespread view was that linear media such as television will also be forced to become interactive. It is not so much that viewers will demand interactivity in the programming although this may happen, but that the economic model for the support of television will be interactive advertising with an eCommerce connection. Simple linear commercials that do not give the viewer an opportunity to buy product will have low value-added.

Equally, while previously many in the interactive community would have said that the spread of high-bandwidth connections to the home was the key to the success of Web media – since high bandwidth is needed for rich media experiences – the developing realization was that high-bandwidth may change the nature of the Web by permitting some companies to gatekeep, and even keep consumers inside a “walled garden” of content.